

Sb61) providing heat from one or more heaters to at least a portion of the formation;
allowing the heat to transfer from one or more of the heaters to a part of the formation such that a permeability of at least a portion of the part of the formation increases to greater than about 100 millidarcy; and
controlling a pressure within at least a majority of the part of the formation, wherein the controlled pressure is at least about 2.0 bar absolute.

E1)
2194. (amended) The method of claim 2193, wherein the one or more heaters comprise at least two heaters, and wherein superposition of heat from at least the two heaters pyrolyzes at least some hydrocarbons within the part of the formation.

Sb61)
2201. (amended) The method of claim 2193, further comprising controlling the heat such that an average heating rate of the part of the formation is less than about 1 °C per day in a pyrolysis temperature range.

E2)
2202. (amended) The method of claim 2193, wherein providing heat from one or more of the heaters to at least the portion of the formation comprises:

heating a selected volume (V) of the coal formation from one or more of the heaters, wherein the formation has an average heat capacity (C_v), and wherein the heating pyrolyzes at least some hydrocarbons within the selected volume of the formation; and

wherein heating energy/day (Pwr) provided to the selected volume is equal to or less than $h*V*C_v*\rho_B$, wherein ρ_B is formation bulk density, and wherein an average heating rate (h) of the selected volume is about 10 °C/day.

Sb61)
2204. (amended) The method of claim 2193, wherein providing heat from one or more of the heaters increases a thermal conductivity of at least a portion of the part of the formation to greater than about 0.5 W/(m °C).

E2)
2216. (amended) The method of claim 2193, further comprising producing a mixture from the formation, wherein the produced mixture comprises a non-condensable component, wherein the

Subj 1
E4
non-condensable component comprises molecular hydrogen, wherein the molecular hydrogen is greater than about 10 % by volume of the non-condensable component at 25 °C and one atmosphere absolute pressure, and wherein the molecular hydrogen is less than about 80 % by volume of the non-condensable component at 25 °C and one atmosphere absolute pressure.

Subj 1
E5
2235. (amended) The method of claim 2193, further comprising:
producing hydrogen (H₂) and condensable hydrocarbons from the formation; and
hydrogenating a portion of the produced condensable hydrocarbons with at least a portion of the produced hydrogen.

Subj 1
E6
2237. (amended) The method of claim 2193, wherein allowing the heat to transfer increases a permeability of a majority of the part of the formation such that the permeability of the part is substantially uniform.

Subj 1
E7
2238. (amended) A method of treating a coal formation in situ, comprising:
providing heat from one or more heaters to at least a portion of the formation;
allowing the heat to transfer from one or more of the heaters to a part of the formation to increase a permeability of a majority of at least a portion of the part of the formation such that the permeability of the majority of the part is substantially uniform; and
controlling the heat such that an average heating rate of the part of the formation is less than about 1 °C per day in a pyrolysis temperature range.

Subj 1
2239. (amended) The method of claim 2232, wherein the one or more heaters comprise at least two heaters, and wherein superposition of heat from at least the two heaters pyrolyzes at least some hydrocarbons within the part of the formation.

Subj 1
2241. (amended) The method of claim 2232, wherein providing heat from one or more of the heaters to at least the portion of the formation comprises:

3
JAS

e

Sub 17 ~~heating a selected volume (V) of the coal formation from one or more of the heaters, wherein the formation has an average heat capacity (C_v), and wherein the heating pyrolyzes at least some hydrocarbons within the selected volume of the formation; and~~

Sub 18 ~~wherein heating energy/day (Pwr) provided to the selected volume is equal to or less than $h \cdot V \cdot C_v \cdot \rho_B$, wherein ρ_B is formation bulk density, and wherein an average heating rate (h) of the selected volume is about 10 °C/day.~~

Sub 19 ~~2233. (amended) The method of claim 2232, wherein providing heat from one or more of the heaters increases a thermal conductivity of at least a portion of the part of the formation to greater than about 0.5 W/(m °C).~~

Sub 20 ~~2235. (amended) The method of claim 2232, further comprising producing a mixture from the formation, wherein the produced mixture comprises a non-condensable component, wherein the non-condensable component comprises molecular hydrogen, wherein the molecular hydrogen is greater than about 10 % by volume of the non-condensable component at 25 °C and one atmosphere absolute pressure, and wherein the molecular hydrogen is less than about 80 % by volume of the non-condensable component at 25 °C and one atmosphere absolute pressure.~~

Sub 21 ~~2234. (amended) The method of claim 2232, further comprising:~~
~~producing hydrogen (H_2) and condensable hydrocarbons from the formation; and~~
~~hydrogenating a portion of the produced condensable hydrocarbons with at least a portion of the produced hydrogen.~~

Sub 22 ~~2235. (amended) The method of claim 2232, wherein allowing the heat to transfer increases a permeability of a majority of the part of the formation to greater than about 100 millidarcy.~~

Sub 23 ~~2231. (amended) A method for treating hydrocarbons in at least a portion of a coal formation, wherein the portion has an average permeability of less than about 10 millidarcy, comprising:~~
~~providing heat from one or more heaters to the formation;~~
~~allowing the heat to transfer from one or more of the heaters to a part of the formation~~

Sub G1
such that heat from one or more of the heaters pyrolyzes at least some hydrocarbons within the part of the formation, and wherein heat from one or more of the heaters increases the permeability of at least a portion of the part of the formation;

producing a mixture comprising hydrocarbons from the formation;

monitoring a composition of the produced mixture; and

controlling a pressure in at least a portion of the formation to control the composition of the produced mixture.

EP2
5082
5082. (amended) The method of claim 5081, wherein the one or more heaters comprise at least two heaters, and wherein superposition of heat from at least the two heaters pyrolyzes at least some hydrocarbons within the part of the formation, and wherein superposition of heat from at least the two heaters increases the permeability of at least the portion of the part of the formation.

Sub G1
5084
5084. (amended) The method of claim 5181, wherein the heat is provided such that an average temperature in the part of the formation ranges from about 270 °C to about 400 °C.

Sub G1
5150. (amended) A method of treating a coal formation in situ, comprising:
providing heat from one or more heaters to at least a portion of the formation;
allowing the heat to transfer from one or more of the heaters to a part of the formation such that a permeability of at least a portion of the part of the formation increases to greater than about 100 millidarcy;
controlling the heat such that an average heating rate of the part of the formation is less than about 1 °C per day in a pyrolysis temperature range; and
controlling formation conditions to produce a mixture from the formation, wherein a partial pressure of H₂ within the mixture is greater than about 0.5 bar.

5151
5151. (amended) The method of claim 5150, wherein the one or more heaters comprise at least two heaters, and wherein superposition of heat from at least the two heaters pyrolyzes at least some hydrocarbons within the part of the formation.

Subj 208
~~5150~~ (amended) The method of claim 5150, wherein providing heat from one or more of the heaters increases a thermal conductivity of at least a portion of the part of the formation to greater than about 0.5 W/(m °C).

Subj 209
~~5151~~ (amended) The method of claim 5150, wherein the produced mixture comprises a non-condensable component, wherein the non-condensable component comprises molecular hydrogen, wherein the molecular hydrogen is greater than about 10 % by volume of the non-condensable component at 25 °C and one atmosphere absolute pressure, and wherein the molecular hydrogen is less than about 80 % by volume of the non-condensable component at 25 °C and one atmosphere absolute pressure.

Subj 210
~~5172~~ (amended) The method of claim 5150, wherein allowing the heat to transfer increases a permeability of a majority of the part of the formation such that the permeability of the majority of the part is substantially uniform.

Subj 211
~~5175~~ (amended) A method of treating a coal formation in situ, comprising:
providing heat from one or more heaters to at least a portion of the formation;
allowing the heat to transfer from one or more of the heaters to a part of the formation such that a permeability of at least a portion of the part of the formation increases to greater than about 100 millidarcy;
controlling a pressure within at least a majority of the part of the formation, wherein the controlled pressure is at least about 2.0 bar absolute; and
producing a mixture from the formation, wherein the produced mixture comprises non-condensable hydrocarbons, and wherein a molar ratio of ethene to ethane in the non-condensable hydrocarbons ranges from about 0.001 to about 0.15.

Subj 212
~~5179~~ (amended) The method of claim 5175, further comprising controlling the heat such that an average heating rate of the part of the formation is less than about 1 °C per day in a pyrolysis temperature range.

~~Sub G1~~ 5181. (amended) The method of claim 5175, wherein providing heat from one or more of the heaters increases a thermal conductivity of at least a portion of the part of the formation to greater than about 0.5 W/(m °C). 107

~~Sub G1~~ 5181. (amended) The method of claim 5175, wherein the produced mixture comprises a non-condensable component, wherein the non-condensable component comprises molecular hydrogen, wherein the molecular hydrogen is greater than about 10 % by volume of the non-condensable component at 25 °C and one atmosphere absolute pressure, and wherein the molecular hydrogen is less than about 80 % by volume of the non-condensable component at 25 °C and one atmosphere absolute pressure. 107

~~Sub G1~~ 5196. (amended) The method of claim 5175, wherein allowing the heat to transfer increases a permeability of a majority of the part of the formation such that the permeability of the majority of the part is substantially uniform. 101

~~Sub G1~~ 5202. (amended) The method of claim 2193, wherein a pyrolysis zone is established in the part of the formation. 133

~~Sub G1~~ 5203. (amended) The method of claim 2193, wherein a pyrolysis zone is established in the part of the formation proximate to and/or surrounding at least one of the heaters. 134

~~Sub G1~~ 5206. (amended) The method of claim 2232, wherein a pyrolysis zone is established in the part of the formation. 131 38

~~Sub G1~~ 5207. (amended) The method of claim 2232, wherein a pyrolysis zone is established in the part of the formation proximate to and/or surrounding at least one of the heaters. 135

~~Sub G1~~ 5210. (amended) The method of claim 5081, wherein a pyrolysis zone is established in the part of the formation. 144 39

Sub G1 142
5211. (amended) The method of claim 5081, wherein a pyrolysis zone is established in the part of the formation proximate to and/or surrounding at least one of the heaters.

Sub G1 143
5215. (amended) The method of claim 5150, wherein a pyrolysis zone is established in the part of the formation.

Sub G1 147 83
5216. (amended) The method of claim 5150, wherein a pyrolysis zone is established in the part of the formation proximate to and/or surrounding at least one of the heaters.

Sub G1 109
5220. (amended) The method of claim 5175, wherein a pyrolysis zone is established in the part of the formation.

Sub G1 150 107
5221. (amended) The method of claim 5175, wherein a pyrolysis zone is established in the part of the formation proximate to and/or surrounding at least one of the heaters.

Sub G1 164
5223. (new) The method of claim 2193, further comprising providing hydrogen (H_2) to the heated part of the formation to hydrogenate hydrocarbons within the part.

Sub G1 155 132
5224. (new) The method of claim 2272, further comprising providing hydrogen (H_2) to the heated part of the formation to hydrogenate hydrocarbons within the part.

Sub G1 150 141
5225. (new) The method of claim 5081, further comprising providing hydrogen (H_2) to the heated part of the formation to hydrogenate hydrocarbons within the part.

Sub G1 151 133
5226. (new) The method of claim 5150, further comprising providing hydrogen (H_2) to the heated part of the formation to hydrogenate hydrocarbons within the part.

Sub G1 158 107
5227. (new) The method of claim 5175, further comprising providing hydrogen (H_2) to the heated part of the formation to hydrogenate hydrocarbons within the part.

Response To Final Office Action Mailed January 2, 2003

A. Pending Claims

Claims 2193-2218, 2220-2239, 2241-2269, 5081-5087, 5089, 5090, 5150-5153, 5155-5192, and 5194-5222 are currently pending. Claims 2193, 2194, 2201, 2202, 2204, 2216, 2225, 2227, 2232, 2233, 2241, 2243, 2255, 2264, 2265, 5081, 5082, 5084, 5150, 5151, 5156, 5167, 5172, 5175, 5179, 5181, 5191, 5196, 5202, 5203, 5206, 5207, 5210, 5211, 5215, 5216, 5220, and 5221 have been amended. Claims 2194, 2201, 2202, 2204, 2216, 2225, 2227, 2233, 2241, 2243, 2255, 2264, 2265, 5082, 5084, 5151, 5156, 5167, 5172, 5179, 5181, 5191, and 5196 have been amended for clarification and/or for correction of typographical errors. Claims 2219, 2240, 5088, 5154, and 5193 have been cancelled. Claims 5123-5127 are new. Support for claims 5123-5127 is found at least in claim 2224.

B. Information Disclosure Statement

Applicant has not received a signed, initialed copy of Form PTO-1449 (1 page, references G6, G9, H2, and J19) submitted with the Information Disclosure Statement mailed on November 12, 2002 (postcard stamped received by the USPTO on November 15, 2002). Applicant respectfully requests a signed, initialed copy of the above-mentioned Form PTO-1449. A copy of the originally filed Form PTO-1449 is enclosed for the Examiner's convenience.

C. The Claims Are Not Indefinite Pursuant To 35 U.S.C. § 112, Second Paragraph

Claims 2193-2196, 2199-2235, 2238-2269, 5081-5090, and 5150-5222 were rejected under 35 U.S.C. § 112, second paragraph, as "being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention." Applicant has amended claims 2193, 2232, 5081, 5150, and 5175 for clarification. Applicant has also amended claims 5202, 5203, 5206, 5207, 5210, 5211, 5215, 5216, 5220, and 5221 as suggested by the Examiner. Applicant respectfully requests removal of the rejections of the claims.

D. Double Patenting Rejection

The Examiner provisionally rejected claims 2193-2269, 5081-5090, and 5150-5222 under the judicially created doctrine of obviousness-type double patenting as being unpatentable over copending U.S. Patent Application No. 09/841,000. Upon issuance of a patent for U.S. Patent Application No. 09/841,000 or the present application, or upon both applications being in condition for allowance but for the provisional double patenting rejection, Applicant will provide arguments for the inappropriateness of the double patenting rejection and/or provide a terminal disclaimer for the patent and/or patent applications.

E. The Claims Are Not Anticipated By Or Obvious Over Ljungstrom Pursuant To 35 U.S.C. § 102(b) or 103(a) Respectively

The Examiner rejected claims 2193-2196, 2200, 2203, 2205-2215, 2217, 2218, 2226, 2227, 2232-2235, 2239, 2242, 2244-2254, 2256, 2257, 2265, 5081-5085, 5175-5178, 5180, 5182-5190, 5192, 5196, 5201-5217, and 5219-5222 under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over U.S. Patent No. 2,923,535 to Ljungstrom et al. (hereinafter “Ljungstrom”). Applicant respectfully disagrees with the rejections.

The Examiner states: “It is noted that claims 2199, 2201, 2219, 2238, 2240, 2258, 5088, 5089, 5179 and 5193 have been rejected only on the grounds of double patenting and/or 35 USC 112(2).” Applicant submits that the 35 USC 112(2) rejections of the claims have been addressed in Section C.

Independent claim 2193 has been amended to include the features of claim 2219. Independent claim 5175 has been amended to include the features of claim 5193. Amended claims 2193 and 5175 describe a combination of features including: “controlling a pressure within at least a majority of the part of the formation, wherein the controlled pressure is at least about 2.0 bar absolute”. Applicant respectfully requests removal of the rejections of claims 2193



and 5175.

Independent claim 2232 has been amended to include the features of claim 2240.

Amended claim 2232 describes a combination of features including: "controlling the heat such that an average heating rate of the part of the formation is less than about 1 °C per day in a pyrolysis temperature range." Applicant respectfully requests removal of the rejection of claim 2232.

Independent claim 5081 has been amended to include the features of claim 5088.

Amended claim 5081 describes a combination of features including: "monitoring a composition of the produced mixture; and controlling a pressure in at least a portion of the formation to control the composition of the produced mixture." Applicant respectfully requests removal of the rejection of claim 5081.

If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988).

Applicants respectfully requests removal of the rejections of claims dependent on claims 2193, 2232, 5081, and 5175. Applicant submits, in addition, that many of the claims dependent on claims 2193, 2232, 5081, and 5175 are separately patentable.

The standard for "anticipation" is one of fairly strict identity. To anticipate a claim of a patent, a single prior source must contain all the claimed essential elements. *Hybritech, Inc. v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 231 U.S.P.Q. 81, 91 (Fed. Cir. 1986); *In re Donahue*, 766 F.2d 531, 226 U.S.P.Q. 619, 621 (Fed. Cir. 1985).

In order to reject a claim as obvious, the Examiner has the burden of establishing a *prima facie* case of obviousness. *In re Warner et al.*, 379 F.2d 1011, 154 U.S.P.Q. 173, 177-178 (C.C.P.A. 1967). To establish a *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 U.S.P.Q. 580 (C.C.P.A. 1974), MPEP § 2143.03.

The Examiner states: "to increase the permeability to greater than 100 millidarcy or 5 Darcy would have been an obvious matter of choice in order to ensure adequate fluid flow through the formation." The Examiner further states: "formations of less than 100 millidarcy are normally characterized or deemed in the art as being of 'low permeability' Since, however, Ljungstrom, as noted above, discloses that the formation is rendered sufficiently permeable by the electrical heating phase to then allow the subsequent in situ combustion phase to be successfully carried out, it must, i.e., inherently, possess a permeability 'greater than 100 millidarcy', as defined by the state of the art observation of Ware et al."

Claim 2226 describes a combination of features including: "increasing a permeability of a majority of the part of the formation to greater than about 5 Darcy." Ljungstrom does not appear to teach or suggest a value of a permeability of a part of a formation. Applicant submits that the heating methods taught and suggested by Ware and/or Ljungstrom would not appear to teach or suggest treating a formation to increase a permeability of the formation to greater than about 5 Darcy. Applicant respectfully requests removal of the rejection of claim 2226.

F. The Claims Are Not Obvious Over Ljungstrom Pursuant To 35 U.S.C. § 103(a)

The Examiner rejected claims 2202, 2204, 2222, 2228, 2229, 2241, 2243, 2261, 2266, 2267, 5181, 5193, 5195, 5197-5200, and 5218 over 35 U.S.C. 103(a) as being unpatentable over Ljungstrom. Applicant respectfully disagrees with the rejections.

At least for the reasons described in Section E, Applicant submits that independent claims 2193, 2232, 5081, 5150, and 5175 are in condition for allowance. Dependent claims 2202, 2204, 2222, 2228, 2229, 2241, 2243, 2261, 2266, 2267, 5181, 5193, 5195, 5197-5200, and 5218 are therefore nonobvious. Applicant therefore requests removal of the rejections of claims 2202, 2204, 2222, 2228, 2229, 2241, 2243, 2261, 2266, 2267, 5181, 5193, 5195, 5197-5200, and 5218. Applicant submits, in addition, that many of the above-listed claims are separately patentable.

The Examiner states: "The precise heating rate and/or thermal conductivity recited in

claims 2201, 2202, 2240, 2241, 5179, are deemed obvious matters of choice or design, especially in carrying out the embodiment in Ljungstrom of controlling and/or maintaining the temperature in the coal formation within a specific operating range (col. 2, lines 25-48).”

Applicant’s Specification discloses: “In an alternative embodiment, at least a portion of the formation may be heated to a temperature such that at least a portion of the hydrocarbon containing formation may be converted to coke and/or char. Coke and/or char may be formed at temperatures above about 400 °C and at a high heating rate (e.g., above about 10 °C/day).” (Specification, page 71, lines 4-7) The recited heating rate appears to have criticality and/or unexpected results not taught or suggested by the cited art.

Amended claims 2202 and 2241 describe a combination of features including: “wherein heating energy/day (P_{wr}) provided to the selected volume is equal to or less than $h*V*C_v*\rho_B$, wherein ρ_B is formation bulk density, and wherein an average heating rate (h) of the selected volume is about 10 °C/day.” Applicant submits that Ljungstrom does not appear to teach or suggest using a desired heating rate to calculate a maximum average heating energy/day to be applied to a selected volume of a formation. Applicant respectfully requests removal of the rejections of claims 2202 and 2241.

G. The Claims Are Not Obvious Over Ljungstrom In View of Tsai Pursuant To 35 U.S.C. § 103(a)

The Examiner rejected claims 2216, 2220, 2221, 2255, 2259, 5150-5170, 5172-5174, 5191, and 5194 under 35 U.S.C. 103(a) as being unpatentable over Ljungstrom as applied to claim 2193 above, and further in view of U.S. Patent No. 4,299,285 to Tsai et al. (hereinafter “Tsai”). Applicant respectfully disagrees with the rejections.

The Examiner states:

While Ljungstrom does not disclose the presence of hydrogen in the

coal heating production effluent, Tsai et al. (col. 5, line 52 – col. 6, line 15) clearly discloses that gasification/volatilization products resulting from heating and/or gasifying a coal formation include hydrogen.

Accordingly, it is deemed that the volatilized/gasified coal production effluent produced in the process of Ljungstrom will obviously include a hydrogen component, as taught by Tsai et al, with the precise amount of hydrogen present, as called for in claims 2216, 2220, 2255, 2259, 5150, 5191, 5194....

Tsai states: "The net result is a combustible product gas comprising carbon monoxide, hydrogen and some methane as its principal combustibles...." (Tsai, col. 5, lines 55-58)

Applicant submits that the Examiner's statement "that the...effluent produced in the process of Ljungstrom will obviously include a hydrogen component...with the precise amount of hydrogen present as called for in claims 2216, 2220, 2255, 2259, 5150, 5191, 5194...." is extending the teaching of Tsai.

Amended claims 2216, 2255, and 5191 describe a combination of features including: "producing a mixture from the formation, wherein the produced mixture comprises a non-condensable component, wherein the non-condensable component comprises molecular hydrogen, wherein the molecular hydrogen is greater than about 10 % by volume of the non-condensable component at 25 °C and one atmosphere absolute pressure, and wherein the molecular hydrogen is less than about 80 % by volume of the non-condensable component at 25 °C and one atmosphere absolute pressure." Applicant submits that the combination of the cited art does not appear to teach or suggest the range of molecular hydrogen content by volume percent recited in claims 2216, 2255, and 5191. Applicant respectfully requests removal of the rejections of claims 2216, 2255, and 5191.

Claims 2220, 2259, and 5194 features including: "controlling formation conditions to produce a mixture from the formation, wherein a partial pressure of H₂ within the mixture is greater than about 0.5 bar." Applicant submits that the combination of the cited art does not appear to teach or suggest controlling formation conditions to produce a mixture from the



formation, wherein a partial pressure of H₂ within the mixture is greater than about 0.5 bar.

Applicant respectfully requests removal of the rejections of claims 2220, 2259, and 5194.

Amended claim 5150 describes a combination of features including: "controlling the heat such that an average heating rate of the part of the formation is less than about 1 °C per day in a pyrolysis temperature range; and controlling formation conditions to produce a mixture from the formation, wherein a partial pressure of H₂ within the mixture is greater than about 0.5 bar."

Applicant submits that the combination of the cited art does not appear to teach or suggest the above quoted features. Applicant respectfully requests removal of the rejections of claim 5150 and claims dependent thereon.

H. The Claims Are Not Obvious Over Ljungstrom In View of Justheim Pursuant To 35 U.S.C. § 103(a)

The Examiner rejected claims 2216, 2220, 2221, 2223, 2224, 2256, 2259, 2260, 2262, 2263, 5150-5174, 5191, and 5194 under 35 U.S.C. 103(a) as obvious over Ljungstrom, as applied to claim 2193, and further in view of U.S. Patent No. 3,766,982 to Justheim (hereinafter "Justheim '982"). Applicant respectfully disagrees with the rejections.

The Examiner states:

As per claims 2216, 2220, 2256 [2255], 2259, 5150, 5191, 5194, in carrying out the injection of hydrogen into the coal formation to effect hydrogenation of the volatilized/pyrolyzed hydrocarbons evolved, in the modified process of Ljungstrom, the production fluids actually produced will necessarily or obviously include a partial pressure of hydrogen, with the precise amount thereof deemed an obvious matter of choice or design, based on, e.g., the particular coal formation encountered.

Amended claims 2216, 2255, and 5191 describe a combination of features including: "producing a mixture from the formation, wherein the produced mixture comprises a non-condensable component, wherein the non-condensable component comprises molecular hydrogen, wherein the molecular hydrogen is greater than about 10 % by volume of the non-



condensable component at 25 °C and one atmosphere absolute pressure, and wherein the molecular hydrogen is less than about 80 % by volume of the non-condensable component at 25 °C and one atmosphere absolute pressure.”

Claims 2220, 2259, and 5194 describe a combination of features including: “controlling formation conditions to produce a mixture from the formation, wherein a partial pressure of H₂ within the mixture is greater than about 0.5 bar.” Amended claim 5150 describes a combination of features including: “controlling the heat such that an average heating rate of the part of the formation is less than about 1 °C per day in a pyrolysis temperature range; and controlling formation conditions to produce a mixture from the formation, wherein a partial pressure of H₂ within the mixture is greater than about 0.5 bar.”

Applicant submits that the Examiner is extending the teaching of Justheim in the rejections of claims 2216, 2220, 2255, 2259, 5150, 5191, and 5194 to include a specific content of a component in a produced mixture (e.g., a partial pressure of H₂ within the mixture greater than about 0.5 bar; greater than about 10 % by volume and less than about 80% by volume of the non-condensable component). Applicant submits that the combination of the cited art does not appear to teach or suggest achieving a specific content of hydrogen in a produced mixture. Applicant respectfully requests removal of the rejections of claims 2216, 2220, 2255, 2259, 5191, and 5194. Applicant further submits that the combination of the cited art does not appear to teach or suggest controlling the heat such that an average heating rate of the part of the formation is less than about 1 °C per day in a pyrolysis temperature range. Applicant respectfully requests removal of the rejections of claim 5150 and claims dependent thereon.

I. The Claims Are Not Obvious Over Justheim Pursuant To 35 U.S.C. § 103(a)

The Examiner rejected claims 5081, 5084, 5086, 5087, 5090, and 5209-5211 under 35 U.S.C. 103(a) as obvious over U.S. Patent No. 3,237,689 to Justheim (hereinafter “Justheim ‘689”) in view of Justheim ‘982. Applicant respectfully disagrees with the rejections.

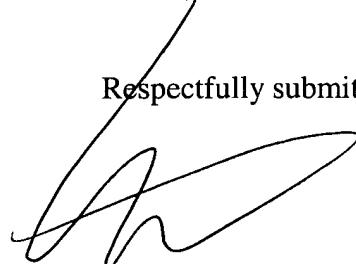
Amended claim 5081 describes a combination of features including: "monitoring a composition of the produced mixture; and controlling a pressure in at least a portion of the formation to control the composition of the produced mixture." The combination of the cited art does not appear to teach or suggest the above-quoted features of claim 5081. Applicant respectfully requests removal of the rejections of claim 5081 and the claims dependent thereon.

J. **Conclusion**

Applicant submits that all claims are in condition for allowance. Applicant submits that the amendments do not require any further search on the part of the Examiner. Favorable consideration is respectfully requested.

Applicant believes that no fees are due with the filing of this document. If any extension of time is required, Applicant hereby requests the appropriate extension of time. If any fees are required, please appropriately charge those fees to Meyertons, Hood, Kivlin, Kowert & Goetzel, P.C. Deposit Account Number 50-1505/5659-06000/EBM.

Respectfully submitted,



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